

Proliferation of Nuclear Weapons: Opportunities for Control and Abolition

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Nuclear weapons pose a particularly destructive threat. Prevention of the proliferation and use of nuclear weapons is urgently important to public health.

“Horizontal” proliferation refers to nation-states or nonstate entities that do not have, but are acquiring, nuclear weapons or developing the capability and materials for producing them. “Vertical” proliferation refers to nation-states that do possess nuclear weapons and are increasing their stockpiles of these weapons, improving the technical sophistication or reliability of their weapons, or developing new weapons.

Because nation-states or other entities that wish to use or threaten to use nuclear weapons need methods for delivering those weapons, proliferation of delivery mechanisms must also be prevented. Controlling proliferation—and ultimately abolishing nuclear weapons—involves national governments, intergovernmental organizations, nongovernmental and professional organizations, and society at large. (*Am J Public Health.* 2007;97:1589–1594. doi:10.2105/AJPH.2006.100602)

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proliferation of nuclear weapons is one of the major challenges we face as a global society. Given that public health is “what we, as a society, do collectively to ensure the conditions in which people can be healthy,”¹(p189) controlling the proliferation of nuclear weapons—and ultimately abolishing them—must be a major global health priority.

The threat posed by the proliferation of nuclear weapons has 3 major aspects:

1. The development of the capability for producing or acquiring nuclear weapons by countries that do not currently have nuclear weapons (horizontal proliferation).
2. The increase of weapon stockpiles by countries that currently have nuclear weapons, the improvement of technical sophistication or reliability of these weapons, and the development of new weapons, such as “mini-nukes” or battlefield nuclear weapons (vertical proliferation).
3. The acquisition of nuclear weapons or the materials and knowledge by individuals or nonstate entities, often termed “terrorists,” to produce nuclear weapons (another form of horizontal proliferation).

Another important component of the nuclear proliferation issue involves delivery mechanisms. In order to pose a nuclear threat, nations or other entities not only need these weapons but also

need missiles or other methods for delivering them.

Controlling proliferation of nuclear weapons involves national governments, intergovernmental organizations, and nongovernmental (civil-society) organizations. Governments thus far have attempted to control the proliferation of nuclear weapons through bilateral and multilateral treaties. Intergovernmental bodies, such as the United Nations, the International Atomic Energy Agency, and the International Court of Justice (World Court), have also attempted to control proliferation. Nongovernmental organizations—including professional organizations, such as the Federation of American Scientists, the International Physicians for the Prevention of Nuclear War (IPPNW), and Physicians for Social Responsibility (IPPNW’s US affiliate)—have worked to control proliferation through education, information dissemination, and advocacy aimed at governments and governmental organizations. An increasing number of individuals and organizations, including senior US statesmen,² believe that the only way to address the danger of nuclear weapons is to eliminate them entirely.

HISTORICAL EVOLUTION OF NUCLEAR WEAPONS

In 1939, Albert Einstein and Leo Szilard warned of developments in Nazi Germany and urged President Franklin D. Roosevelt to begin a research

program on nuclear fission for military use.³ The Manhattan Project⁴ was established in 1941 to develop, produce, and test the first “atomic bombs,” and J. Robert Oppenheimer was appointed director.^{4,5} On July 16, 1945, the first “atomic bomb” was tested at Alamogordo, NM,^{4,6} and on August 6 and 9 of the same year, US military aircraft dropped atomic bombs on Hiroshima and Nagasaki, Japan. These bombs, based on nuclear fission, each had an explosive power equivalent to about 20 000 tons (20 kilotons) of TNT. Together, they caused the immediate deaths of approximately 200 000 people and the subsequent deaths of thousands more from blast and thermal injuries, radiation sickness, and malignancies.^{4,7}

Despite opposition by Oppenheimer and other physicists, President Harry Truman ordered development work on bombs based on nuclear fusion—termed “thermonuclear weapons,” “hydrogen bombs,” or “H-bombs”—in 1951. The work was performed under the direction of Edward Teller, who had urged the development of a fusion weapon while working on the Manhattan Project. The first hydrogen bomb test took place in 1952 at Eniwetok Atoll in the Marshall Islands. The blast had an explosive power equivalent to 10 400 000 tons (10.4 megatons) of TNT—500 times greater than the power of each of the bombs dropped on Hiroshima and Nagasaki. In 1953, the Soviet Union, which

had exploded its first fission bomb in 1949, exploded its first fusion bomb.⁸ In 1961, the Soviet Union detonated a fusion bomb with a yield equivalent to 50 megatons of TNT—over 2000 times greater than the yield of the Hiroshima and Nagasaki bombs and greater than the total destructive power of all the bombs and explosives used in World War II.^{9,10} The development of these weapons led to the initiation of a worldwide movement for nuclear disarmament.¹¹

After the release of information on the physical effects of thermonuclear weapons and testimony before a Congressional committee about the effects of a possible thermonuclear attack on the United States,¹² a group of Boston physicians analyzed the medical consequences of such an attack. Their papers, published in the *New England Journal of Medicine*,^{13–15} led in 1962 to the formation of Physicians for Social Responsibility in the United States and in 1980 to the establishment of IPPNW, a worldwide federation of national medical organizations.¹⁶ IPPNW received the Nobel Prize for Peace in 1985 in recognition of its work in easing tensions that threatened nuclear war between the United States and the Soviet Union.^{10,17,18}

PROLIFERATION OF NUCLEAR WEAPONS

Horizontal Proliferation

The United States and the Soviet Union remained the only states with nuclear weapons until 1952, when the United States provided nuclear weapons to the United Kingdom. Other nations then began to acquire nuclear weapons: France,¹⁹ China,²⁰ and, it is believed, Israel.²¹ South Africa initiated, but later

terminated, a nuclear weapons program.^{22,23} India and Pakistan each conducted explosive tests of nuclear weapons in 1998.^{24,25} In 2003, The Democratic People's Republic of Korea (North Korea) unilaterally withdrew from the Nuclear Non-Proliferation Treaty (NPT) and expelled the international inspectors who had been monitoring its stockpile of fissile materials. Despite attempts by a 6-nation group to get North Korea to end its development of nuclear weapons, North Korea announced in 2006 that it had the capability to construct nuclear weapons and apparently tested one.²⁶ In the same year, North Korea unsuccessfully tested several ballistic missiles capable of carrying nuclear warheads, and the United Nations Security Council unanimously adopted a resolution demanding that it suspend its missile program and banned all UN member states from (1) selling material or technology for missiles or weapons of mass destruction to North Korea, and (2) receiving missiles, banned weapons, or related technology from North Korea. North Korea immediately rejected the Security Council's decision.^{27,28} In July 2007 North Korea agreed to permanent disabling of a nuclear reactor complex at Yongbyon.²⁹

In 2003, Iran, which is a member of the NPT, had begun to build a uranium-enrichment facility that could have the capability to produce uranium suitable for use in nuclear weapons.³⁰ In mid-2006, a 6-nation group presented Iran with a set of proposals that called for a halt in uranium enrichment in return for economic and diplomatic incentives and warned that if Iran failed to respond, they would refer the case to the UN Security

Council.³¹ Iran continues to insist that its enrichment plans are purely for civilian use.³² Although analysts believe Iran is still some years away from building nuclear weapons, there is concern that the United States may stage a military attack on Iran's nuclear capabilities.^{33–34}

Vertical Proliferation

Several of the nations with nuclear weapons have worked to develop new types of nuclear weapons and to improve and maintain existing ones. The Bush administration is pursuing development of a range of new warheads under the Reliable Replacement Warhead program and is implementing plans for a complete renewal of nuclear weapons complex infrastructure.³⁵ The United States has proposed development of new nuclear weapons, such as small tactical nuclear weapons ("mini-nukes"), but Congress has blocked funding for these projects.³⁶ The United Kingdom is planning to invest £1 billion to update its Atomic Weapons Establishment at Aldermaston and to maintain its Trident warhead stockpile.³⁷ The British Parliament may be asked to replace 1 or more of its 4 Trident submarines, each of which can carry 48-kiloton nuclear warheads.³⁸ Russia has also announced plans to maintain or improve its nuclear arsenals,³⁹ and Pakistan may be expanding its nuclear program.⁴⁰

Acquisition by Individuals or Nonstate Entities

Individuals or nonstate entities may attempt to acquire nuclear weapons or the materials and know-how to produce them. There is considerable dispute over the use of the term *terrorism*, which many believe

should include actions intended to produce terror by nation-states ("state terrorism") as well as by nonstate entities. But we will use the terms *terrorism* and *terrorist*, as they are commonly used, to refer only to nonstate entities. Concerns have been raised about the potential acquisition of nuclear weapons by nonstate entities from nation-states that possess these weapons.^{41–43} The Nunn-Lugar Cooperative Threat Reduction Program, designed to lessen the possibility that nuclear weapons could be obtained from Russia, has been only partially successful.^{44,45} In addition, there is concern about the possibility that nonstate entities will obtain fissile materials and the technical capability for producing nuclear weapons,^{46,47} and about the possibility of those entities making so-called dirty bombs—explosive or incendiary weapons purposely contaminated with radioactive materials. Although dirty bombs are defined as radiological rather than nuclear weapons, they could nonetheless create widespread radioactive contamination and instill great fear in the general population.

Controlling the Proliferation of Nuclear Weapons

Many of the physicists who worked on the Manhattan Project urged that the ready-for-use atomic bombs be detonated as a dramatic demonstration on an uninhabited island rather than on Japanese cities. After the bombs fell on Hiroshima and Nagasaki, these physicists and others, through the Federation of American Scientists and the *Bulletin of the Atomic Scientists*, worked to prevent proliferation and to urge the destruction of existing stockpiles. Work to end nuclear proliferation by other

civil-society organizations, including IPPNW and its affiliates in 60 countries, has been heightened through the production of further reports on the health and environmental consequences of nuclear weapons use.^{48–54}

Another concern is the possibility of the accidental firing of nuclear missiles in response to false warnings of a nuclear attack. There have been close calls, in which nuclear missiles—many of which are on hair-trigger alert—were being prepared for launch on the basis of faulty reports of incoming missiles.⁵⁵

Limited Nuclear Test Ban Treaty

During the Cold War, both the United States and Soviet Union sought to deter each other from the use of nuclear weapons, through a policy known as mutual assured destruction (MAD).⁵⁶ The first international agreement that attempted to control the testing of nuclear weapons, the 1963 Limited Nuclear Test Ban Treaty (LTBT), was signed by the United States, the United Kingdom, and the Soviet Union. It prohibited nuclear test explosions in the atmosphere, in space, or underseas. The LTBT was initiated by President John F. Kennedy when evidence was presented of fallout of radioisotopes after each atmospheric nuclear test. In 1997, the National Cancer Institute published a study on the risk of the development of thyroid cancer from the iodine-131 fallout from the nearly 100 atmospheric nuclear bomb tests during the 1950s and the 1960s. It was estimated that 17 200 new cases of thyroid cancer would develop annually in the United States.⁵⁷ Nuclear weapons tests have continued

since the LTBT has been ratified and implemented; but tests have been conducted underground or by simulation.⁵⁸

Anti-Ballistic Missile Systems Treaty

In 1972, the Treaty on the Limitation of Anti-Ballistic Missile Systems (ABM Treaty) between the United States and Soviet Union was signed in Moscow. It was ratified by the US Senate and went into effect soon afterward. The United States and the Soviet Union signed a protocol to the treaty, which went into force in 1976, that reduced the number of ABM deployment areas from 2 to 1—deployed either around each party's national capital area or at a deployment area of a single intercontinental ballistic missile. The Soviet Union deployed an ABM system around Moscow, but the United States elected not to deploy an ABM system. The United States withdrew from the treaty in 2002 in order to permit work on a national missile defense system, work that had been prohibited by the treaty. After the United States withdrew from the treaty, it announced plans to deploy interceptor missiles in Poland and a radar system for missile defense in the Czech Republic. Then, Russia tested a new multiple-warhead intercontinental ballistic missile and a new cruise missile with a range of up to 500 kilometers. Although the President of Russia, Vladimir Putin, and other officials have called the treaty outdated, they have not said that Russia would opt out of it.

Treaty on the Non-Proliferation of Nuclear Weapons

In 1968, the Treaty on the Non-Proliferation of Nuclear Weapons, also referred to as the NPT, was first signed.⁵⁹ It

obligates the 5 original nuclear-weapon states (the United States, the Soviet Union, the United Kingdom, France, and China) not to transfer nuclear weapons, other nuclear explosive devices, or their technology to any non-nuclear-weapons state. Non-nuclear-weapons states that are parties to the NPT undertake an avoidance of acquisition or production of nuclear weapons or nuclear explosive devices, in return for acquisition of nuclear technologies for peaceful activities, such as power generation, and for protection by the nuclear-weapon states. They are required also to accept safeguards to detect diversions of nuclear materials from peaceful activities to the production of nuclear weapons or other nuclear explosive devices.

The NPT went into effect in 1970. In 1992, China and France acceded to it. In 1996, Belarus joined Ukraine and Kazakhstan in removing and transferring to the Russian Federation the last of the remaining former Soviet nuclear weapons located within their territories, and each of these nations has become a party to the NPT, as a non-nuclear-weapon state.

The NPT is the most widely-accepted arms control agreement. Cuba, Israel, India, and Pakistan were the only major nations that were not parties to the NPT, until North Korea unilaterally withdrew—a withdrawal that was not recognized by the other 187 parties. India and Pakistan acquired nuclear weapons capability during the 1990s while remaining outside the NPT. Israel is said to retain a significant nuclear weapons capability also outside the NPT.

The Bush administration, in 2005, signed an agreement with India to provide assistance in the

development of nuclear energy for civilian use. Some analysts contend that the agreement will undermine the NPT, which India has not joined, by providing benefits that are currently reserved for parties to the NPT. The US Congress approved the agreement in late 2006.

International Court of Justice Advisory Opinion

Under the NPT, the nuclear-weapons states assumed an obligation to pursue negotiations for nuclear disarmament. In 1996, the International Court of Justice handed down an Advisory Opinion on the request made by the General Assembly of the United Nations and by the World Health Organization for an opinion on the legality of the use or threat of use by a state of nuclear weapons in armed conflict. In a split decision, the Court stated that “in view of the current state of International Law, and of the elements of fact at its disposal, the Court cannot conclude definitively whether the threat or use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defense, in which the very survival of a State would be a stake.” But the Court ruled unanimously that “there exists an obligation to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament in all its aspects under strict and effective international control.”^{60,61}

Model Nuclear Weapons Convention

In 1997, the United Nations General Assembly called for negotiations leading to the conclusion of a Nuclear Weapons Convention. That same year, the Lawyers' Committee on Nuclear Policy (part of the International Association of Lawyers Against

Nuclear Arms, IALANA), the International Network of Engineers and Scientists for Global Responsibility, and IPPNW released the Model Nuclear Weapons Convention at the United Nations as part of an international campaign to stimulate the commencement of negotiations on an international treaty to abolish nuclear weapons. Abolition 2000, an international network of over 700 organizations, supports the approval and implementation of such a treaty.

The Model Nuclear Weapons Convention would prohibit the development, testing, production, stockpiling, transfer, use, and threat of use of nuclear weapons. States possessing nuclear weapons would be required to destroy their arsenals according to a series of phases over 15 years. The convention would also prohibit the production of weapons-usable fissile material and require delivery vehicles to be destroyed or converted to make them incapable of nuclear uses. The proposed convention outlines a series of 5 phases for the elimination of nuclear weapons: taking nuclear weapons off alert, removing weapons from deployment, removing nuclear warheads from their delivery vehicles, disabling the warheads, removing and disfiguring the plutonium “pits” needed for nuclear weapons and placing the fissile material under international control. In the initial phases, the United States and Russia would be required to make the deepest cuts in their nuclear arsenals.⁶²

THE CURRENT SITUATION

There are approximately 27 000 nuclear warheads worldwide, with an explosive force

TABLE 1—Global Nuclear Weapons Stockpile, by Country: 2006

Country	Estimated No. of Nuclear Warheads
Russia	16 000
United States	10 000
China	200
France	350
United Kingdom	200
Israel	100
India	70–110
Pakistan	50–110
North Korea	Perhaps 2
Total	27 000

Source. References 63–66.

equivalent to 10 billion tons of TNT—almost 2 tons for every human being (Table 1).^{63–66} The warheads produce a force more powerful than 200 000 of the bombs dropped on Hiroshima. About 2000 to 3000 of these warheads are mounted on missiles that are on hair-trigger alert for “launch on warning”; that is, they are ready to be launched on a few minutes’ notice. About 10 000 are inactive, i.e., they are not currently mounted as warheads on missiles or ready to be dropped from airplanes. Both the active and inactive weapons and stockpiles of plutonium and highly enriched uranium, from which nuclear weapons could be constructed, remain in nations’ stockpiles.

The Bush administration is pursuing development of new warheads and a complete renewal of the US nuclear weapons complex infrastructure. The US policy, as elaborated in the National Security Strategy of 2002, undermines the NPT and all arms-control accords by asserting that nuclear weapons and other weapons of mass destruction are

only dangerous if in the hands of so-called dangerous people. This policy, therefore, rejects a general nonproliferation standard. The administration has rejected 40 years of bipartisan nonproliferation and arms-control policy in favor of a policy of “counterproliferation,” thereby doing serious damage to global efforts to contain the spread of nuclear weapons and move toward their elimination. Its counterproliferation policy and military doctrine allows for the use of nuclear weapons to bring about the nuclear disarmament of an enemy state.

The lack of disarmament progress, with nuclear weapons retaining a central role in the defense and security strategies of nuclear-weapon states, has impeded efforts to prevent proliferation and provides an excuse for those who seek to acquire nuclear weapons in contravention of their obligations under the NPT and other international treaties.^{67,68}

At a conference in 2006 organized by IPPNW, Abolition 2000 Europe, IALANA, and the International Peace Bureau—to mark the 10th anniversary of the advisory opinion on nuclear weapons issued by the International Court of Justice—attendees noted the lack of progress toward implementation of the unanimous opinion of the court on the obligation “to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament.”⁶¹ The conference urged that the UN General Assembly, which had together with the World Health Organization requested the advisory opinion from the court in 1996, be asked to return to the court with evidence that little progress had been made in response to the court opinion and with a request for a new advisory opinion that

would clarify the meaning of “good faith” negotiations and of bringing them to a conclusion.

PUBLIC HEALTH PRACTICE

The contributions of public health workers to the prevention of war, and specifically to the control of nuclear proliferation, have taken a wide variety of forms and have been published in a wide variety of venues. Some contributions cover a wide spectrum of public health activities to prevent war.⁶⁹ Some are specific to nuclear weapons abolition.^{70–71} Some deal with blocking production of fissionable material that might be used in nuclear weapons.⁷² Some deal with the perceptions of local residents about the risks of nuclear weapons production.⁷³ Some, the most risky for public health care workers, deal with activities of health workers working in war zones to seek to prevent the continuation of war.⁷⁴ Overall, the contributions of public health workers to disarmament and peace have been extremely important.

In many ways, the dangers posed by the proliferation of nuclear weapons are greater now than ever before. Although these issues may seem distant from the day-to-day practice of public health in a state or local health department, healthcare institution, or academic public health practice environment, there is much that public health workers can do to address the challenges posed by the proliferation of nuclear weapons. Public health workers can educate colleagues, policymakers, and the general public about these issues and disseminate information to them. They can advocate for stronger national and international policies to control the proliferation of

nuclear weapons. They can help strengthen public health preparedness in their local areas in the event of a dirty bomb attack. And, through their membership and participation in professional, advocacy, and other nongovernmental organizations, they can play important roles in helping to stop the spread of nuclear weapons and, ultimately, to eliminate these weapons. ■

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This article was accepted January 4, 2007.

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The authors jointly conducted the research and wrote the article.

Acknowledgments

The authors are grateful to the following individuals who have significantly contributed to our understanding of the issues: Lachlan Forrow, MD, Jack Geiger, MD, Robert Gould, MD, John Loretz, Patrice Sutton, MPH, and the anonymous reviewers of this article.

The authors acknowledge Patrice Sutton, MPH, and Robert Gould, MD, for the development of Table 1.

Human Participant Participation

No protocol approval was needed.

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